CS413 Lab 2 ARM Stack Program
Areas of Plane Shapes Calculator

The purpose of this program is to get the student to use the stack to pass parameters to and from their own defined subroutines/functions in ARM Assembly.

Write an ARM Assembly program that will calculate the area of the following four plane shapes:
   a) Triangle
   b) Rectangle
   c) Trapezoid
   d) Square

All number inputs are integers and all calculation results are provided in integer format. Any fractional calculations are to be truncated.

The program must all meet the following requirements:
   1. Each area calculation must be accessed as a subroutine/function (ARM instruction BL).
   2. The operands are passed to the function via the stack. Use the ARM pseudo instructions PUSH and POP. To ensure you are properly implementing the stack the registers used in your main routine to hold the operands must be different than those used in the subroutines. For example, your calling routine will push r4 and r5 on the stack but the called routine will pop into registers r10 and r11.
   3. The function returns the results on the top of the stack.
   4. Your program is to print a welcome/instruction messages to the user.
   5. The user is prompted to enter the calculation type and the appropriate number of **positive** integers.
   6. The program shall verify the user input is valid and report any entry errors. Ensure your program checks for non-integer inputs (string, floating-point, characters). Invalid entries are reported and user prompted again to enter a valid input.
   7. The program shall perform the calculation, display the results and report any overflow errors. Overflow is when the results do not fit into 32-bit unsigned format.
   8. Ask the user if they want to continue with another calculation or quit the program.

The GTAs will run your program to ensure correct functioning and will also review your code to ensure you have properly implemented the functions and stacks.

As with all programs your program:
   1. Checks user inputs for errors and prints appropriate error messages.
   2. All outputs are clearly labeled.
   3. Contains generous code documentation.

Your program needs to be well documented. Points will be deducted for code which is poorly documented. See the Student Lab Handbook for expected code comments.

Prework:
Students need to have a file which, at the very least contain the following:
   1. Proper header information that include commands that assemble, link, run the file and run the file using the debugger that is specific for their file.
   2. Data section that defines all the output strings.
   3. Code comment sections that describe the major sections of the code with the functions for the four area calculations clearly identified.

This assignment was last given in:

Spring 2020

Fall 2021

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Student _____   Lab Instructor: _____

Total Score: _____   Late Penalty? No _____   Yes: _____

Feature	Points off
Code Comments/Documentation • Class, Term, Author, Date. • Purpose of software • Documentation for the start of each loop and function (subroutine) • Documentation for error checking • In-line comments that explain why the following code exists.	
Welcome and instruction message are displayed and clear.	
Does the program reject invalid inputs for the area calculation to perform? Students are expected to use character or integer inputs to select the area calculation type.	
Does the program reject the following invalid inputs for positive integers: A, abc, -10, and 0 for each of the area input functions?	
After each time an invalid integer is input does the program prompt for a valid entry?	
Does the program have a Quit option at the main menu and does it return control to the OS?	
Select triangle with the following numbers: 10, 50. Result should be 250 square units.	
Select rectangle with the following numbers: 10, 50. Result should be 500 square units.	
Select trapezoid with the following numbers: a=10, b=30, h=50. Result should be 1000 square units.	
Select square with the following number: 50. Result should be 2500 square units.	
Select triangle with the following numbers: 120000, 670000. Result should be overflow.	
Select rectangle with the following numbers: 670000, 680000. Result should be overflow.	
Select trapezoid with the following numbers: a=670000, b=670000, h=670000. Result should be overflow.	
Select square with the following number: 67000. Result should be overflow.	
Note 2^ 32 = 4,294,967,296 which is the maximum unsigned integer for 32-bits.	